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Age and Gender Detection System Using Audio Analysis

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Abstract: *Automatic inference of demographic attributes such as age and gender from speech signals has gained significant attention in the field of paralinguistic speech analysis due to its wide applicability in human–computer interaction, biometric authentication, and intelligent voice-enabled systems. This paper presents a robust and scalable age and gender detection framework that operates on short-duration audio recordings and performs non-intrusive demographic classification. The proposed system leverages advanced digital signal processing techniques to extract discriminative acoustic features, including Mel Frequency Cepstral Coefficients (MFCCs) and spectral descriptors, which effectively model human auditory perception and vocal tract characteristics.*

The classification pipeline employs a hybrid learning strategy, where gender recognition is performed using a deep multi-layer perceptron architecture, while age estimation is addressed using an ensemble of machine learning models comprising K-Nearest Neighbors (KNN), Long Short-Term Memory (LSTM), XGBoost, and Multi-Layer Perceptron (MLP). Extensive experimental evaluation conducted on a large-scale, real-world speech corpus demonstrates that distance-based classifiers outperform deeper architectures when feature engineering is optimized, achieving high accuracy and robustness across multiple age groups. The system is deployed using a service-oriented architecture to enable real-time inference, validating its suitability for practical applications such as adaptive user interfaces, call-center analytics, and voice-based biometric systems...

Keywords: Age estimation, Gender recognition, Speech signal processing, Paralinguistic analysis, MFCC, Ensemble learning, Deep learning, Audio biometrics, Human–computer interaction

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